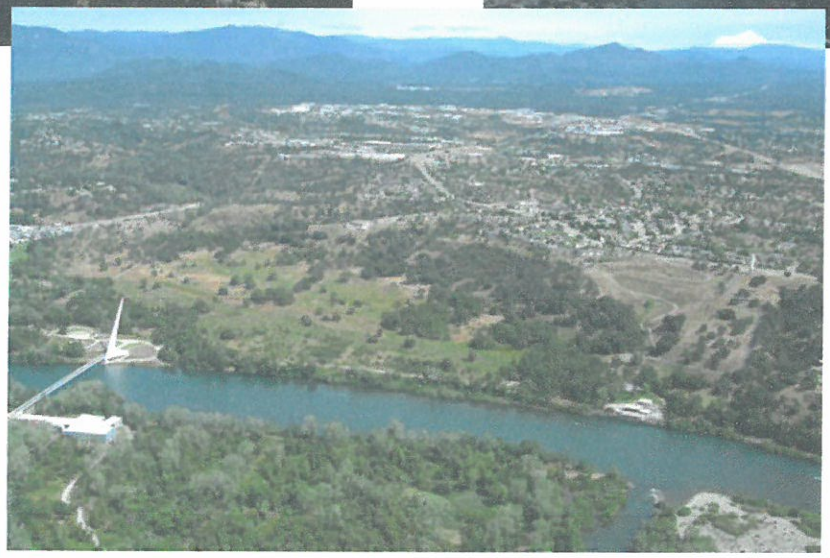
REDDING AREA
WATERSHED SANITARY SURVEY

TRINITY WATERSHED

WHISKEYTOWN WATERSHED

SHASTA WATERSHED

SACRAMENTO RIVER WATERSHED



2011

PACE ENGINEERING
REDDING, CALIFORNIA

Mt. Lassen, Spring Creek Reservoir, & City of Redding's Buckeye Water Treatment Plant

Iron Mountain Mine is no longer an uncontrolled source of heavy metals into the Redding Area Watersheds.

Mt. Shasta

The crown jewel in the North State and repository for much of our summer water supply.

Sacramento River, Mt. Shasta, Sundial Bridge, & Bella Vista Water District's Wintu Pump Station

Note the juxtaposition that recreation and our primary water source have in the Redding area.

Photos: By Eric Marshall, PACE Engineering Technician

PACE ENGINEERING

February 25, 2011

1748.02

Mike McNamara
California Department of Public Health
415 Knollcrest Drive, Suite 110
Redding, CA 96002

Dear Mike,

Subject: 2010 Redding Area Watershed Sanitary Survey

PACE Engineering is pleased to submit the:

REDDING AREA WATERSHED SANITARY SURVEY

The Redding Area Watershed Sanitary Survey is a group effort by local Public Water Systems (PWS) who have combined their resources to update the previous Watershed Sanitary Survey completed in 2006.

Chapter 17, Surface Water Treatment, Article 7, Section 64665 of Title 22 of the California Code of Regulations requires water utilities using surface water to conduct a watershed sanitary survey every five years. Under Section 64665, a watershed sanitary survey should include:

- Physical and hydrogeological description of the watershed.
- Summary of source water quality monitoring data.
- A description of activities and sources of contamination.
- A description of any significant changes that have occurred since the last survey.
- A description of watershed control and management practices.
- An evaluation of the PWS ability to meet the requirements, and recommendations for corrective actions.

The survey and report includes four watershed groups including: (1) Shasta Lake Watershed from Goose Lake in Oregon to Shasta Dam; (2) Trinity Watershed including Clair Engle Lake and Lewiston Lake; (3) Whiskeytown Watershed including Clear Creek and Whiskeytown National Recreation Area; and (4) Sacramento River Watershed from Shasta Dam to the raw water intakes for the City of Redding and Bella Vista Water District.

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The report is subdivided into the following sections:

1. Executive Summary
2. Participating Agencies
3. Report Objectives and Previous Studies
4. The Watersheds
5. Communications and Emergency Response
6. Drinking Water Regulations
7. Water Treatment Facilities and Treatment Processes
8. Potential Watershed Contaminant Sources
9. Water Quality Review

The report includes references, and a number of tables and figures that pertain to and are located at the end of each of the sections listed above.

PACE Engineering is very pleased to have participated in this project. We would like to thank the staffs from all the participating agencies for their able assistance and the California Department of Public Health and Central Valley Regional Water Quality Control Board for making their files available to our many inquiries.

Written comments from all the participating agencies and CDPH on the draft report issued on December 1st, 2010 were incorporated into the final report. Their comments and edits were beneficial, and contributed to improving the overall quality of the Watershed Sanitary Survey.

Sincerely,

Thomas W. Warnock
Principal Engineer

TWW/KD
Enclosures
cc:w/report: Don Groundwater, District Engineer, Bella Vista Water District
Jon McClain, Assistant Public Works Director, City of Redding
Char Workman-Flowers, CEO/CFO, Clear Creek CSD
Bill Bishop, Water Treatment Superintendent, City of Shasta Lake
Mike Berlien, General Manager, Centerville CSD
Ken Mariette, Interim General Manager, Shasta CSD
Eric Wedemeyer, Supervising Engineer, Shasta County
Jeff Cole, Interim General Manager, Mt. Gate CSD
Dave Larabee, Facility Manager, Whiskeytown National Recreation Area
Sandi Tenney, Associate Engineer, CDPH
Bryan Smith, Senior Engineer, CRWQCB

REDDING AREA
WATERSHED SANITARY SURVEY
FOR

BELLA VISTA WATER DISTRICT

CITY OF REDDING

CLEAR CREEK COMMUNITY SERVICES DISTRICT

CITY OF SHASTA LAKE

CENTERVILLE COMMUNITY SERVICES DISTRICT

MOUNTAIN GATE COMMUNITY SERVICES DISTRICT

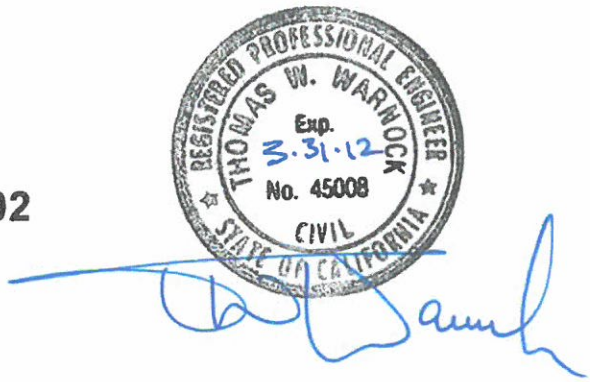
SHASTA COMMUNITY SERVICES DISTRICT

SHASTA COUNTY WATER AGENCY

WHISKEYTOWN NATIONAL RECREATION AREA

2011

JOB NO 1748.02



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REDDING, CALIFORNIA

PARTICIPATING AGENCIES

Don Groundwater, District Engineer, Bella Vista Water District
Jon McClain, Assistant Public Works Director, City of Redding
Char Workman-Flowers, CEO/CFO, Clear Creek Community Services District
Bill Bishop, Water Treatment Superintendent, City of Shasta Lake
Mike Berlien, General Manager, Centerville Community Services District
Ken Mariette, Interim General Manager, Shasta Community Services District
Eric Wedemeyer, Supervising Engineer, Shasta County Water Agency
Jeff Cole, Interim General Manager, Mt. Gate Community Services District
Dave Larabee, Facility Manager, Whiskeytown National Recreation Area

REGULATORY AGENCIES

Mike McNamara, Lassen District Engineer, California Department of Public Health
Robert Crandall, Assistant Executive Officer, California Regional Water Quality Control Board, Central Valley Region

PACE ENGINEERING, INC.

Tom Warnock, Project Manager
Grant Maxwell, Staff Engineer
Eric Marshall, Engineering Technician/Photographer

TABLE OF CONTENTS

SECTION

TABLE OF CONTENTS

SECTION

TABLE OF CONTENTS

SECTION

TABLES

TABLE OF CONTENTS

TABLES

TABLE OF CONTENTS

FIGURES

TABLE OF CONTENTS

FIGURES

1.0 EXECUTIVE SUMMARY

The California Surface Water Treatment Rule requires water utilities using surface water or groundwater under the direct influence of surface water to conduct a watershed sanitary survey every five years. This watershed sanitary survey, called the Redding Area Watershed Sanitary Survey, is a group effort by local public water systems (PWS) who have combined their resources to update the two previous watershed sanitary surveys completed in 2001, and amended in December 2006. The original 2001 survey reviewed the Whiskeytown Watershed, the lower Sacramento River Watershed from Shasta Dam to the Bella Vista Water District raw water intakes, and the nearby areas around Shasta Lake in the Shasta Watershed. This survey updates the previous survey. The 2006 and 2010 surveys have been expanded to include Trinity, Lewiston, upper Sacramento River, and the complete Shasta Watersheds.

The aim of the survey is to examine the PWS watersheds, and water treatment systems to determine potential threats to their water quality, as well as their ability to treat the water. The *Watershed Sanitary Survey Guidance Manual*, by the California-Nevada Section of the American Waterworks Association, December 1993, was used as a guide to create major topics for the chapters. Each of the four major watersheds has its own major subheading within related chapters. Each chapter has a list of references, which has been included to facilitate the next update in 2015. Future updates can research the references provided and revise the existing document.

The Redding Area Watershed Sanitary Survey was prepared by PACE Engineering for the PWS that use the Whiskeytown, Trinity, Shasta Lake, and Upper Sacramento River Watersheds as their primary water supply. The PWS that participated in this sanitary survey include the Bella Vista Water District, City of Redding, Clear Creek Community Services District, Shasta Community Services District, Mountain Gate Community Services District, Centerville Community Services District, City of Shasta Lake, Whiskeytown National Recreation Area, and Shasta County Service Areas No. 2

Sugarloaf, No. 3 Castella, No. 6 Jones Valley, No. 11 French Gulch, No. 23 Crag View, and No. 25 Keswick.

The PWS participating in this sanitary survey rely upon four major surface water sources: Shasta Lake, Trinity Lake, Whiskeytown Lake, and the Sacramento River. The combined area of the watershed is nearly 5.5 million acres, and almost all of the land is not owned or controlled by the PWS. Only the Whiskeytown National Recreation Area (NRA), as administered by the National Park Service, under the United States Department of the Interior, exercises some control over its watershed. Consequently, most of the PWS are dependent on federal and state agencies to oversee and protect their water quality.

Several watersheds are interlinked by conduits that bypass their natural drainage systems. Water from the Trinity and Lewiston Reservoir system is diverted into Whiskeytown Lake through penstocks at the Carr Powerhouse. This water in turn can be diverted through the Spring Creek conduit forebay of the Keswick Dam on the Sacramento River. Therefore, the City of Redding's Foothill WTP and the Bella Vista Water District draw a mixture of water from all four watersheds reviewed in this report. The Shasta Community Services District, City of Redding's Buckeye WTP, and Shasta County Service Area No. 25 Keswick draw waters from the Spring Creek conduit which originates from the Trinity and Lewiston Reservoirs via Whiskeytown Lake. The Clear Creek Community Services District and Centerville Community Services District draw water from the Muletown conduit which originates from the Trinity and Lewiston Reservoirs via Whiskeytown Lake at the dam. Even though the National Park Service Carr Memorial Treatment Facility is located next to Whiskeytown Lake, it draws water from the Clear Creek conduit, and uses water only from Trinity and Lewiston Reservoirs.

Highways and railroads often parallel waterways and their drainage systems often direct runoff into the nearest waterway. The key to dealing with an accidental spill is communication between federal, state, local agencies, and the PWS. State and federal

agencies are in place to coordinate efforts and coordinate communications should an accidental spill occur.

Water facilities whose intakes are located on rivers or creeks are at greater risk from accidental spill and landslides, as opposed to those on lakes that benefit from dilution, settling, and residence time. Fortunately, the creeks used by the County Service Areas do not appear to receive drainage from major highways, and seem to have little if any industrial related traffic in their local upstream watersheds. Landslides resulting in high turbidities are probably of greater concern, and these facilities should investigate whether they need to install raw water turbidimeters and develop procedures for early detection of highly turbid water and automatic shutdown of the WTP until on-site assessment and process adjustments can be made.

Compared to other PWS, perhaps the water agency at greatest risk from an accidental spill may be the Bella Vista Water District because its intakes are located just downstream of two major thoroughfares: Highway 273 and the Southern Pacific Railroad crossing at the Diestlehorst Bridge. The District does monitor and control for high turbidity and conductivity at the Wintu Pump Station and backup wells and interties with neighboring water agencies can deliver an alternate water supply in the event of a spill.

Many of the water treatment facilities operated by participating agencies are over 30 years old and use in-line filtration technology to treat the water. At the time of construction, in-line filtration technology met standards set by the United States Environmental Protection Agency (USEPA) and the California Department of Public Health (CDPH). However, since then in-line filtration has been shown not to be as effective at removing *Giardia* and *Cryptosporidium* from drinking water as conventional filtration. Therefore, CDPH requires that these systems prove their effectiveness at removing these protozoans through surrogate turbidity or particle removal studies. Of the 18 water treatment facilities operated by the agencies participating in this sanitary survey, 12 are believed to be in-line filtration systems (see Table 7.1). Several of these

PWS have proven that they can reliably achieve less than 0.1 NTU turbidity in 95% of the turbidity measurements collected and therefore are now considered equivalent to an approved technology.

Disinfection byproducts appear to be a problem with some water treatment systems. Disinfection byproducts are a consequence of the chlorine dose used to meet State standards for *Giardia* inactivation.

The overall quality of water from the four watersheds is quite good due in part to:
1) large volumes of water captured by the watersheds, which dilute contaminants;
2) presence of five lakes, which allow contaminants to settle out of the water; and
3) land management regulations of local, state, and federal agencies. It can be argued that the greatest threats to water quality appear to be the possibility of high turbidity from landslides and erosion, particularly in the Trinity and Whiskeytown Watersheds, and the potential of contamination from accidental spills from highway and railroad accidents, particularly for the Sacramento River and Shasta Lake.

Perhaps, the best news that this sanitary survey can offer are the results of 49 months of raw water sampling by the City of Redding, Bella Vista Water District, and Clear Creek CSD for *Cryptosporidium* in the Spring Creek conduit and Sacramento River, as required under the Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR). Sampling results for the Spring Creek conduit and Sacramento River indicate that no addition of *Cryptosporidium* removal or inactivation technology will be required under LT2ESWTR.

In addition, major remediation efforts at Iron Mountain Mine, including the recently completed sludge dredging work on the Spring Creek arm of Keswick Lake, have removed an estimated 100,000 cubic yards of contaminated sludge.

Looking forward one might anticipate that implementation of stricter erosion control and monitoring practices under new Storm Water Pollution Prevention Plans as required by

the California Regional Water Quality Control Board will certainly increase monitoring requirements and likely result in improved erosion control efforts on construction projects.

The 2010 Watershed Sanitary Survey is structured the same as the 2006 Watershed Sanitary Survey. Major changes that have occurred in the watershed over the past five years have been highlighted in the following chapters.

1.1 ABBREVIATIONS AND TERMS

Ac-Ft - acre feet
AL - action level
AFO - animal feeding operation
AFR - accidental fecal release
ASL - above sea level

BAT - best available technologies
BLM – Bureau of Land Management
BMP - best management practice
BVWD - Bella Vista Water District

CAFO - concentrated animal feeding operation
Cal EMA – California Emergency Management Agency
Caltrans - California Department of Transportation
CCL - contaminant candidate list
CCCSD – Clear Creek Community Services District
CCSD – Centerville Community Services District
CCR - California Code of Regulations
CDF – California Department of Forestry
CDFA - California Department of Food and Agriculture

CDPH – California Department of Public Health

CDP&R - California Department of Parks and Recreation

CDPR - California Department of Pesticide Regulation

CERCLA - Comprehensive Environmental Response and Liability Act

CMOM - Capacity, Management, Operations, and Maintenance Program

CMP - Coordinated Monitoring Program

COR – City of Redding

CRWQCB – California Regional Water Quality Control Board

CSA – County Service Area

COSL – City of Shasta Lake

CT – Product of chlorine residual and contact time

CUPA - Certified Unified Program Agency

CWA - Clean Water Act

CWS - Community Water System

D/DBPR - Disinfection/Disinfection By-Product Rule

DBP - disinfection by-product

DBW - California Department of Boating and Waterways

DFG - California Department of Fish and Game

DLR - Detection Limit for Reporting Purposes

DOC - dissolved organic carbon

DTSC - California Department of Toxic Substances Control

DWR - California Department of Water Resources

DWSAP - Drinking Water Source Assessment and Protection Program

E. coli — *Escherichia coli*

ESWTR - Enhanced Surface Water Treatment Rule

FIFRA - Federal Insecticide, Fungicide, and Rodenticide Act

FT - feet

GPM – gallons per minute

GPM/SF – gallons per minute per square foot

GPS - global positioning system

GWR - Groundwater Rule

GWUDIS - groundwater under the direct influence of surface water

HAA - haloacetic acids

HWY - Highway

ICR - Information Collection Rule

IESWTR - Interim Enhanced Surface Water Treatment Rule

IOC - inorganic compound

LCR - Lead and Copper Rule

LT1ESWTR - Long Term 1 Enhanced Surface Water Treatment Rule

LT2ESWTR - Long Term 2 Enhanced Surface Water Treatment Rule

LUST - leaking underground storage tank

MCL - maximum contaminant level

MCLG - maximum contaminant level goal

MG - million gallons

MGD - million gallons per day

MPN - most probable number

MRDL - maximum residual disinfectant level

MRDLG - maximum residual disinfectant level goal

MTBE - methyl tert-butyl ether

MGCSD – Mountain Gate Community Services District

NCWS - Non-Community Water System

NPDES - National Pollution Discharge Elimination System

NPDWR - National Primary Drinking Water Regulations

NTNCWS - Non-Transient Non-Community Water System

NTU - nephelometric turbidity unit

PCA - potentially contaminating activities

ppb - parts per billion

ppm - parts per million

ppt - parts per trillion

PSI - pounds per square inch

PWS - public water system

RAC – Resource Advisory Council

RCD – Resource Conservation District

SCADA - Supervisory Control and Data Acquisition

SDWA - Safe Drinking Water Act

SF - square feet

SCSD - Shasta Community Services District

SOC - synthetic organic compound

spp. - species

SRWP - Sacramento River Watershed Program

SSO - sanitary sewer overflow

SSV – Small System Variance

SWPP - Source Water Protection Program

SWRCB - State Water Resources Control Board

SWTR - Surface Water Treatment Rule

TAC - Technical Advisory Committee

TCD - temperature control device

TCR - Total Coliform Rule

TNCWS - Transient Non-Community Water Systems

TOC - total organic carbon

TSS - total suspended solids

TTHM - total trihalomethanes

USBLM - United States Bureau of Land Management

USBR – United States Bureau of Reclamation

USEPA - United States Environmental Protection Agency

USFS - United States Forest Service

USGS - United States Geological Survey

VOC - volatile organic compound

WDR - waste discharge requirements

WNRA – Whiskeytown National Recreation Area

WSS - Watershed Sanitary Survey

WTP - water treatment plant

WWTP - wastewater treatment plant


1"=150,000
THE GOOSE LAKE WATERSHED DOES NOT CURRENTLY DRAIN INTO THE SHASTA WATERSHED*
OREGON
CALIFORNIA
TRINITY WATERSHED
SHASTA WATERSHED
NEVADA
WHISKEYTOWN WATERSHED
SACRAMENTO RIVER WATERSHED
CITY OF REDDING
* THE GOOSE LAKE WATERSHED DOES NOT CURRENTLY DRAIN INTO THE SHASTA LAKE WATERSHED; HOWEVER, IT HAS IN THE PAST BEEN A PART OF THE WATERSHED, AND IS SHOWN IN CASE REHABILITATION EFFORTS TO INCREASE FLOWS TO THE LAKE SUCCEED. SEE TEXT FOR FURTHER DETAILS.

2.0 PARTICIPATING WATER AGENCIES

The 2011 Redding Area Watershed Sanitary Survey update is a joint effort by the following PWS:

- Bella Vista Water District
- City of Redding
- Clear Creek Community Services District
- City of Shasta Lake
- Centerville Community Services District
- Mountain Gate Community Services District
- Shasta County Service Areas:
  - Sugarloaf CSA No. 2
  - Castella CSA No. 3
  - Jones Valley CSA No. 6
  - French Gulch CSA No. 11
  - Crag View CSA No. 17
  - Keswick CSA No. 23
- Shasta Community Services District
- Whiskeytown National Recreation Area

The above PWS are henceforth referred to as the "participating agencies" in this Redding Area Watershed Sanitary Survey. Figure 1.0 shows the location of the watersheds included in this report. Figures 4.1 through 4.4 show the watershed boundaries and Figures 4.5 through 4.6 show service area boundaries of the participating agencies.